**T04D02 - Chemical Bonding Properties Lab – Ionic, Covalent, Metallic, Network**

Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Introduction/Background:**

Solid crystals consist of a regular array of particles located at specific lattice points in a three-dimensional lattice work – think of a building put together with steel framing. The forces of attraction which hold crystals together differ and exhibit characteristic properties. There are four principle classes of crystalline solids: ionic, covalent, network covalent, and metallic. *Ionic bonds* are those in which electrons are transferred from one atom to a more electronegative atom. *Covalent bonds (also known as Molecular bonds)* are bonds which have a strong intra-molecular attraction within the molecules as atoms gain stability by sharing electrons. The inter-molecular forces of attraction between covalent molecules are not especially strong, but on occasion can be in which case they would be considered *network covalent bonds*. These have a strong inter-molecular force of attraction. *Metallic bonds* consist of positively charged metal ions (cations) organized in a lattice surrounded by a ‘sea’ or ‘cloud’ of delocalized, mobile electrons. The force of attraction between the metallic cations and the surrounding ‘cloud’ of electrons constitutes the metallic bond.

In the experiment, you will examine selected properties of sodium iodide, NaI, and Lauric Acid, CH3(CH2)10COOH.

**Objective:**

When you have completed this activity, you should be able to:

1. Construct a list of observable properties for ionic and molecular crystals
2. Distinguish between intra- and inter-molecular forces from characteristic properties.

**Materials:**

* Goggles ● Electrical conductivity apparatus
* Evaporating dish ● Test tubes (2)
* Bunsen burner ● Iron ring and stand
* Methanol (CH3OH) ● Stoppers (2)
* Sodium iodide (NaI) ● Lauric Acid (CH3(CH2)10COOH)

**Procedure:**

Goggles must be worn at all times

1. For volatility, waft solid compound. Record. When heating later you may record the smell again.
2. Test the hardness of the solids by rubbing a small sample of each between your fingers.
3. Place pea-sized samples of both compounds in clean/dry evaporating dishes, test conductivity.
4. Test the relative melting temperatures of the two solids in the evaporating dish. Heat strongly and note the time required for melting. AS SOON AS MELTING BEGINS, REMOVE FROM HEAT! (If you don’t our classroom will smell for days). Remember to record the smell.
5. Test the solubility of Lauric Acid in toluene by adding 5 mL of toluene to the evaporating dish of Procedure #3 and stir thoroughly. CAUTION: TOLUENE IS VERY FLAMMABLE. DO NOT USE NEAR ANY FLAME. Complete the same for sodium iodide.
6. Place a few crystals of Lauric Acidin a test tube containing about 10 mL of water. Test the solubility by stoppering the test tube and mixing well. Allow to stand for a period of time and record your observations. Complete for sodium iodide as well.
7. For conductivity of the solution you will place the conductivity tester in the solution of water! Rinse well following.

**Data Table**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Properties** | **NaI**  **(ionic)** | **CH3(CH2)10COOH (cov/molecular)** | **Copper, Cu**  **(metallic)** | **Graphite, C**  **(network)** |
| Volatility  (high or low) |  |  |  |  |
| Melting Point  (high or low) |  |  |  |  |
| Solubility in water  (soluble or insoluble) |  |  |  |  |
| Solubility in toluene  (soluble or insoluble) |  |  |  |  |
| Electric conductivity in solid state (yes or no) |  |  |  |  |
| Electrical conductivity in liquid state (yes or no) |  |  |  |  |
| Hardness or Texture  (brittle or soft) |  |  |  |  |

If you finish early, you may test copper and graphite, metallic and network covalent compounds respectively. If time does not allow, simply make predictions or research the literature values, be sure to state as such in your lab report.

Report will be based on Conclusion and evaluation for IB, still provide a brief data table with explanation as well as relevant background information and literature values for comparison.